CLAIMS

1. A transmitter for transmitting a data signal, the transmitter comprising:

a driver circuit for generating a drive signal, the driver circuit being capable of adjusting the drive signal in response to at least one feedback signal;

a data transmitter for receiving the drive signal and for generating the data signal in response to the drive signal;

a first sensor capable of detecting the data signal to generate a first signal containing a first characteristic;

a second sensor capable of detecting the data signal to generate a second signal containing a second characteristic; and

a processor for receiving at least one of the first and second signals, for generating said at least one feedback signal in response to at least one of the first and second characteristics, and for providing said at least one feedback signal to the driver circuit.

2. The transmitter according to claim 1, wherein the data signal comprises at least one selected from a group consisting of an analog signal and a digital signal.

3. The transmitter according to claim 1, wherein the driver circuit, the data transmitter, the first and second sensors and the processor are fabricated on a common semiconductor substrate.

4. The transmitter according to claim 1, further comprising a power splitter for splitting the data signal

to at least first and second data signal portions, wherein the first sensor detects the first data signal portion and the second sensor detects the second data signal portion.

5. The transmitter according to claim 1, wherein the first characteristic of the data signal comprises high frequency characteristics.

6. The transmitter according to claim 1, wherein the second characteristic of the data signal comprises source parameters.

7. The transmitter according to claim 1, wherein the data transmitter comprises a laser, and the data signal comprises an optical data signal.

8. The transmitter according to claim 1, wherein the first sensor has at least as high bandwidth characteristics as a sensor expected to be provided at a receiver end to detect the data signal.

9. The transmitter according to claim 1, wherein the first sensor has at least as low noise characteristics as a sensor expected to be provided at a receiver end to detect the data signal.

10. The transmitter according to claim 1, wherein the first sensor has at least one selected from a group consisting of lower bandwidth characteristics and higher noise characteristics as compared to a sensor expected to be provided at a receiver end, and wherein at least one of

said lower bandwidth characteristics and said higher noise characteristics is compensated through equalization.

11. The transmitter according to claim 1, wherein the processor comprises means for emulating channel degeneration, said channel degeneration emulating means being capable of degenerating the first signal based on said at least one feedback signal to generate a degenerated data signal, which emulates the data signal as detected at a receiver end.

12. The transmitter according to claim 11, wherein the processor further comprises means for emulating a data receiver at the receiver end, and wherein said receiver emulating means receives the degenerated data signal and the drive signal, generates a recovered drive signal by applying the degenerated data signal to the emulation of the data receiver, and compares the recovered drive signal with the drive signal to generate a bit compare error count.

13. The transmitter according to claim 12, wherein the processor further comprises means for generating at least one selected from a group consisting of discrete optical parameters, data integrity parameters and a data-eye, using at least one of the first and second signals.

14. The transmitter according to claim 13, wherein the processor is capable of performing spec compliance testing using at least one selected from a group consisting of the discrete optical parameters, the bit compare error count, the data integrity parameters and the data-eye.

15. The transmitter according to claim 12, wherein the processor is capable of performing bit error rate (BER) testing using the bit compare error count.

16. The transmitter according to claim 13, wherein the processor is capable of comparing the data-eye against a data-eye mask.

17. The transmitter according to claim 14, wherein one or more of said discrete optical parameters and data integrity parameters are compared against limit values specified in one or more specifications during the spec compliance testing.

18. The transmitter according to claim 1, wherein the driver circuit comprises a phase locked loop (PLL), and wherein at least one of the feedback signals is used to adjust bandwidth and gain of the PLL.

19. The transmitter according to claim 18, wherein the PLL receives a reference clock signal, the reference clock signal contains jitter noise, and wherein the feedback signal is used to vary the bandwidth and gain of the PLL so as to filter out the jitter noise.

20. The transmitter according to claim 18, wherein the data transmitter comprises a laser diode, the PLL receives an input data signal and is used to generate a control data signal based on the input data signal, the driver circuit further comprises a laser diode driver for receiving the control data signal and for generating the

drive signal, the laser diode receives the drive signal to generate the data signal, the data signal comprises an optical data signal, and wherein high speed parameters of the PLL and the high speed parameters of the laser diode driver are used together towards optimizing the quality of the optical data signal, and wherein the control data signal comprises at least one selected from a group consisting of a voltage signal and a current signal.

21. The transmitter according to claim 20, wherein the PLL receives a reference clock signal, the reference clock signal contains jitter noise, wherein the jitter noise is passed to the driver circuit in the control data signal and then to the laser diode in the drive signal, wherein the optical data signal includes the jitter noise, and wherein the jitter noise in the optical data signal is reduced by varying bandwidth and gain of the PLL using at least one of the feedback signals.

22. The transmitter according to claim 1, wherein the data transmitter comprises a laser diode for receiving the drive signal, wherein the drive signal comprises an electrical drive signal, said laser diode for generating an optical data signal, the optical data signal includes at least one non-optimum parameter selected from a group consisting of a bit error rate, a data-eye, data integrity parameters and discrete optical parameters, the drive signal including a plurality of currents, and wherein at least one of the plurality of currents is varied towards optimizing said at least one non-optimum parameter.

23. The transmitter according to claim 22, wherein the data integrity parameters comprise at least one selected from a group consisting of average power (P_{ave}), extinction ratio (ER), optical modulation amplitude (OMA), rise and fall times, overshoot and undershoot, duty cycle distortion (DCD), data dependent jitter (DDJ), periodic jitter (PJ), random jitter (RJ), power supply rejection ratio (PSRR), and electromagnetic interference (EMI) generation and susceptibility.

24. The transmitter according to claim 22, wherein the discrete optical parameters comprise at least one selected from a group consisting of center wavelength (λc), spectral width ($d\lambda rms$), sidemode suppression ratio (SMSR), polarization, modal noise (MN), mode partition noise (MPN), chirping, relative intensity noise (RIN), beam divergence angle ($\Delta\theta$) and optical return loss (ORL).

25. The transmitter according to claim 22, wherein the plurality of currents comprise at least one selected from a group consisting of a bias current (I_{bias}), a modulation current (I_{mod}), a rise time peaking (pk+) current, a fall time peaking (pk-) current and a duty cycle distortion (DCD) current.

26. The transmitter according to claim 1, wherein the data signal is provided to a transmission medium for receipt by a receiving end, a portion of the transmitted data signal is reflected back from the receiving end, at least one of the first and second sensors is capable of detecting the reflected back signal, and wherein the

processor uses the reflected back signal to generate said at least one feedback signal.

27. The transmitter according to claim 26, wherein a data-eye of the data signal is compared against the data-eye of the reflected back signal to determine the data-eye of the transmitted data signal expected to be detected at the receiving end.

28. A method of adjusting signal quality of a data signal provided by a transmitter, the method comprising:

generating a drive signal;

generating the data signal in response to the drive signal;

splitting the data signal to at least first and second data signal portions;

generating a first signal containing a first characteristic by detecting the first data signal portion;

generating a second signal containing a second characteristic by detecting the second data signal portion;

generating at least one feedback signal in response to at least one of the first and second characteristics; and

adjusting the drive signal in response to said at least one feedback signal.

29. The method according to claim 28, wherein the first characteristic comprises high frequency characteristics.

30. The method according to claim 28, wherein the second characteristic comprises source parameters.

31. The method according to claim 28, wherein generating the data signal comprises generating an optical data signal.

32. The method according to claim 28, further comprising degenerating the first signal by emulating channel degeneration and applying the first signal to the emulation of channel degeneration, wherein the degenerated first signal emulates the data signal as detected by a sensor at a receiver end.

33. The method according to claim 32, further comprising:

emulating a data receiver expected to be provided at a receiver end;

generating a recovered drive signal by applying the degenerated first signal to the emulation of the data receiver;

delaying the drive signal; and

comparing the recovered drive signal against the delayed drive signal to generate a bit compare error count.

34. The method according to claim 33, further comprising generating at least one selected from a group consisting of discrete optical parameters, data integrity parameters and a data-eye, using at least one of the first and second signals.

35. The method according to claim 34, the method further comprising performing spec compliance testing using at least one selected from a group consisting of the

discrete optical parameters, the bit compare error count, the data integrity parameters and the data-eye.

36. The method according to claim 33, further comprising performing bit error rate (BER) testing using the bit compare error count.

37. The method according to claim 34, further comprising comparing the data-eye against a data-eye mask.

38. The method according to claim 35, wherein performing spec compliance testing comprises comparing at least one of said discrete optical parameters and data integrity parameters against corresponding limit values specified in at least one specification.

39. A method of adjusting an optical quality of a laser diode output, the method comprising:

extracting first and second feedback data signals from the laser diode output;

detecting high frequency characteristics of the laser diode output from the first feedback data signal;

detecting laser source characteristics of the laser diode output from the second feedback data signal; and

providing at least one feedback adjustment signal based on at least one of the high frequency characteristics and the laser source characteristics to adjust the optical quality of the laser diode output.

40. The method according to claim 39, further comprising performing spec-compliance testing using at

least one of the high frequency characteristics and the laser source characteristics.

41. The method according to claim 39, further comprising performing bit error rate (BER) testing using at least one of the high frequency characteristics and the laser source characteristics.

42. The method according to claim 40, wherein performing spec-compliance testing includes comparing at least one of discrete optical parameters and at least one of discrete optical data integrity parameters against predetermined limit values.

43. The method according to claim 42, further comprising increasing margin of at least one of said discrete parameters, a data-eye and a bit error rate having relatively low margin at the risk of potentially degenerating at least one of said discrete parameters, the data-eye and the bit error rate having releatively high margin.

44. The method according to claim 39, wherein the laser source characteristics are detected using spatial characteristics.

45. The method according to claim 39, wherein the laser source characteristics are detected using spectral characteristics.

46. A transmitter for transmitting a plurality of data signals, the transmitter comprising:

a driver circuit for generating a plurality of drive signals, the driver circuit being capable of adjusting the drive signals in response to a plurality of feedback signals, at least one feedback signal corresponding to each drive signal;

a data transmitter for receiving the drive signals and for generating the data signals in response to the drive signals;

a plurality of first sensors, each first sensor being capable of detecting one of the data signals to generate a corresponding one of a plurality of first signals containing first characteristics;

a plurality of second sensors, each second sensor being capable of detecting one of the data signals to generate a corresponding one of a plurality of second signals containing second characteristics; and

a processor for receiving the first signals and the second signals, for generating the feedback signals in response to the first and second characteristics, and for providing the feedback signals to the driver circuit.

47. The transmitter according to claim 46, wherein the data transmitter comprises a laser array for receiving the drive signals and for generating the data signals, wherein the data signals comprise optical data signals, and wherein the feedback signals are used to adjust optical quality of the optical data signals.

48. A method of adjusting optical quality of a plurality of laser outputs, each laser output corresponding to one of an array of lasers, the method comprising:

extracting first and second feedback data signals from each laser output;

detecting high frequency characteristics of the laser output from each of the first feedback data signals;

detecting laser source characteristics of the laser output from each of the second feedback data signals; and

providing a plurality of feedback adjustment signals based on the high frequency characteristics and the laser source characteristics, each feedback adjustment signal for adjusting optical quality of the corresponding laser output.

49. The method of adjusting the optical quality according to claim 48, further comprising decreasing optical crosstalks between different channels of the array of lasers using the feedback adjustment signals.

50. A transmitter for transmitting a data signal, the transmitter comprising:

a driver circuit for generating a drive signal, the driver circuit being capable of adjusting the drive signal in response to at least one feedback signal;

a data transmitter for receiving the drive signal and for generating the data signal in response to the drive signal;

a sensor capable of detecting the data signal to generate a signal containing high frequency characteristics of the data signal; and

a processor for receiving the signal, for generating said at least one feedback signal in response to

the high frequency characteristics, and for providing said at least one feedback signal to the driver circuit.

51. The transmitter according to claim 50, wherein the high frequency characteristics comprise at least one selected from a group consisting of rise and fall times, overshoot and undershoot, duty cycle distortion (DCD), data dependent jitter (DDJ), periodic jitter (PJ) and random jitter (RJ).

52. A transmitter for transmitting an optical signal, the transmitter comprising:

a driver circuit for generating a drive signal, the driver circuit being capable of adjusting the drive signal in response to at least one feedback signal;

an optical transmitter for receiving the drive signal and for generating the optical signal in response to the drive signal;

a sensor capable of detecting the optical signal to generate a signal with characteristics of discrete optical parameters of the data signal; and

a processor for receiving the signal, for generating said at least one feedback signal in response to the discrete optical parameters, and for providing said at least one feedback signal to the driver circuit,

wherein the discrete optical parameters comprise at least one selected from a group consisting of center wavelength (λc), spectral width ($d\lambda rms$), sidemode suppression ratio (SMSR), polarization, modal noise (MN), mode partition noise (MPN), chirping, relative intensity noise (RIN) and beam divergence angle ($\Delta\theta$).